

REMARKS

The Office action rejected the claims under 35 U.S.C. §§ 103 and 112. Applicant amended claims 1 and 18; and added new claims 42-45. Claims 1, 2, 4-20 and 22-45 remain. Applicants request that the Examiner reconsider and withdraw the rejections. A Petition for a three month extension of time accompanies this Reply as a separate paper.

I. Claim Rejections - 35 U.S.C. § 112

The Office action rejected claims 1, 2, 4-31 and 41 as lacking enablement and claims 18-31 for being indefinite. Applicants removed the "generally similar" language from claim 1 without prejudice. Such a description is unnecessary to define an invention that is patentable over the cited references.

As for the "remaining away" language of claim 18, Applicants modified such phrase to state that the contact remains "a distance" away from the circuit substrate. Applicant used such language to differentiate between the present invention and certain cited references. In a BGA connector such as the present invention, the solder masses, not the contacts, engage the circuit substrate. In distinction, certain of the cited references describe contacts that mount within through-holes in the PCB or directly engage the PCB. These references include Kandybowski (e.g. ground terminal 76 in Figure 2), Feldman (e.g. post 14 of ground bus 12 in Figure 1), Korsunsky (e.g. pins 74 of bus bar 70 in Figure 2), Fedder (e.g. posts 56,66 of contacts 52,58 in Figures 2, 3 and 4), and Romine (e.g. pin contacts 26 in Figure 4).

Support for this clarification appears in the original disclosure. Applicants direct the Examiner to Figure 33. Although the circuit substrate is not shown in the figure, one of

ordinary skill in the art would understand that, when the connector is mounted to the circuit substrate, the solder masses would directly engage the circuit substrate. Since the solder masses extend from the contacts, the contacts would clearly "remain a distance away" from the circuit substrate as described in the claim. Applicants request that the Examiner reconsider and withdraw the rejections.

II. Claim Rejections - 35 U.S.C. § 103(a)

The Office action repeated the obviousness arguments from the previous Office action. Since the rejections involve multiple references, Applicant has divided the discussion below into segments. First, however, Applicants have briefly summarized the requirements of an obviousness rejection below.

Applicants encourage the Examiner to contact the undersigned to discuss the arguments made herein and, if necessary, to discuss changes which would place the case in condition for allowance.

A. The Obviousness Standard

A *prima facie* case of obviousness has three elements. One element requires that the references teach all of the claimed features. Another element demands that a suggestion or motivation exist to combine references. The final element requires a reasonable expectation of success in combining the references.

Applicants assert that this Office action, as well as the earlier Office actions, has failed to establish a *prima facie* case of obviousness. Simply put, the Examiner has cited multiple references, with each of the multiple references merely satisfying a portion of the features recited in the claims. The Examiner has then aggregated these multiple references with a conclusory statement that the multiple references satisfy all

of the claimed features. However, the Examiner has failed to establish a motivation for the combination of these multiple references. That was improper.

A suggestion or motivation must exist to combine references. *In re Rouffet*, 149 F.3d 1350 (Fed. Cir. 1998). Broad, conclusory statements are unacceptable. *In re Dembicza*k, 175 F.3d 994 (Fed. Cir. 1999). The Federal Circuit has cautioned that “the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references.” *In re Gartside*, 203 F.3d 1305, 1319 (Fed. Cir. 2000). Stated differently, the motivation to combine references must be “clear and particular.” *Dembicza*k, 175 F.3d at 999. The Examiner has failed to provide this clear and particular showing.

B. The Rejection over Fedder, Kandybowski, Feldman or Korsunsky in view of Noschese, Swamy, Romine, Teka, Lin, Seidler and Electronics

The Office action rejected claims 1-41 as being unpatentable under 35 U.S.C. § 103(a) over Fedder, Kandybowski, Feldman or Korsunsky in view of Noschese, Swamy, Romine, Teka, Lin, Seidler and Electronics. For the various reasons enumerated below, the rejection should be withdrawn.

1. Claims 1, 2 and 4-17

Independent claim 1 recites, *inter alia*, that the signal contacts have a mating portion with “an elongated cross-section” arranged transversely between the elongated cross-sections of the ground or power contacts such that one end “is located adjacent” one of the ground or power contacts, and the other end “is located adjacent” another of the ground or power contacts.

Neither Fedder, Kandybowski, Feldman nor Korsunsky disclose such an arrangement. In fact, none of the remaining references provides a motivation for such a modification.

The Office action stated that “whether or not the contacts are arranged in a specific manner should not overcome the prior art.” Applicants respectfully disagree. As described in the specification, a unique aspect of the present invention involves the “I-beam transmission line geometry.” Generally speaking, and as shown in Figures 1 and 1a, I-beam geometry places signal contacts generally transverse to the ground/power contacts.

The specification and figures show that that the I-beam arrangement provides a strong loading of the signal contacts through the ground/power contacts and a light loading between adjacent signal contacts. This light loading between adjacent signal contacts provides improved cross-talk performance, in particular a low rise time cross-talk product.

One benefit of the I-beam geometry is the ability to increase the signal-to-ground ratio of the contacts. As seen in Figure 18, the rise time cross-talk product is substantially independent of signal density for signal-to-ground ratios greater than 1:1. In other words, a virtual ground appears to exist between adjacent signal contacts. This allows signal contacts to be placed adjacently (*i.e.* without a ground contact positioned therebetween). This clearly helps increase signal-to-ground density.

Therefore, Applicants disagree with the Examiner’s statement that “whether or not the contacts are arranged in a specific manner should not overcome the prior art.” Applicants request that the Examiner reconsider and withdraw the rejection.

In addition to the above discussion regarding independent claim 1, Applicants assert that dependent claim 13 itself defines an invention that is patentable over the cited references. Claim 13 recites, *inter alia*, “recesses” in which the mounting portions of the contacts reside. None of the cited references disclose or suggest such an arrangement. Applicants request that the Examiner reconsider and withdraw the rejection of claim 13.

2. Claims 18-31

Independent claim 18 recites, *inter alia*, an electrical connector with contacts that “remain[] a distance away from the circuit substrate” and have solder masses “fused” thereto “before said connector mounts to the circuit substrate.”

(a) “Remaining a Distance Away”

Fedder, Kandybowski, Feldman and Korsunsky fail to disclose or to suggest this feature. Fedder, as seen in Figure 1, discloses connectors (12, 70) that mount to through holes (134, 140) in the PCBs (130,136). Feldman, as seen in Figure 3, disclose connectors (2,4) with contacts (12) that mount to through-holes in a PCB (6,8). Korsunsky, as seen in Figure 2, discloses connectors (16,18) with ground contacts (70,170) having tails (74,174) that extend into through holes in the PCBs. Clearly, through hole-mounted contacts do not satisfy the “remaining a distance away” recitation of claim 18.

Kandybowski discloses both a through-hole mounted connector (22) and a surface mounted connector (84). In either case, the contacts do not “remain a distance away” from the circuits substrate as described in the claim. The contacts of the through-hole

mounted connector extend into the circuit substrate, and the contacts of the surface mounted contact directly engage the circuit substrate.

Furthermore, no suggestion has been clearly asserted which provides a motivation to modify Fedder, Kandybowski, Feldman or Korsunsky to satisfy the features of claim 18. For at least this reason, the rejection should be withdrawn. Applicants request that the Examiner reconsider and withdraw the rejection.

(b) Fused to the “Contact”

Swamy and Lin fail to disclose or to suggest this feature. Swamy discloses solder balls (212) attached to pads (210) on the bottom of the connector (200). Lin discloses a semiconductor die (12) with solder bumps (16) secured to bonding pads (14). No motivation has been established to utilize these references in securing a solder mass to a contact of an electrical connector as described in the claim. For at least this reason, the rejection based upon these references should be withdrawn. Applicants request that the Examiner reconsider and withdraw the rejection.

(c) “Fused” to the Contact “Before” the Connector Mounts to the Circuit Substrate

Romine, Seidler and Teka fail to disclose or to suggest this feature. As provided in column 3, lines 19 and 20 of Romine, the solder pellets (52) are preferably “stuck in and on the cavity 50 with a suitable adhesive.” When mounting the connector to the PCB, “the header 30 and board 22 can be placed in an assembly oven, and the temperature within the oven raised sufficiently to melt the reflux solder pellets 52.” Seidler discloses a solder mass (26) placed between tabs (18) on the contact (10). The solder mass is subsequently heated to secure the connector to a PCB. Likewise, Teka, appears to disclose an electronic component with a lead having a shaped piece of solder placed

thereon. No motivation has been established to utilize these references in fusing a solder mass to the contact before the connector mounts to the circuit substrate. For at least this reason, the rejection based upon these references should be withdrawn. Applicants request that the Examiner reconsider and withdraw the rejection.

In addition to the above discussion of independent claim 18, Applicants assert that dependent claims 22-25 themselves define inventions that are patentable over the cited references. Claim 22 recites, *inter alia*, that the housing has “recesses” in which the mounting portions of the contacts reside. None of the cited reference disclose or suggest such an arrangement. Applicants request that the Examiner reconsider and withdraw the rejection of claims 22-25.

3. Claims 32-41

Applicants assert that the rejection was improper and must be withdrawn. Claim 32 recites, *inter alia*, an electrical connector with a solder mass “fused” to the tail portion of the contact “prior to” the electrical connector securing to the substrate so that the solder mass is located “further” from the housing than the contact.

(a) Solder Mass “Further” from Housing

Fedder, Kandybowski, Feldman and Korsunsky fail to disclose or to suggest this feature. Fedder (Figure 1), Feldman (Figure 3) and Korsunsky (Figure 1) disclose connectors that mount to through-holes in a PCB. It would appear that placing the solder mass at the end of a through hole-mounted contact prevents the contact from aligning with and entering the through-hole of the PCB. For at least this reason, the rejection based upon these references was improper and must be withdrawn.

Kandybowski discloses, in one embodiment (connector 22 in Figure 4), a through hole-mounted connector, and, in another embodiment (connector 84 in Figure 4), a surface-mounted connector in which the contacts directly engage the PCB. It would appear that placing the solder mass at the end of the contact prevents the contact from aligning with and entering the through-hole or prevents the contact from engaging the PCB directly. For at least this reason, the rejection based upon this reference was improper and must be withdrawn.

In addition, no suggestion has been clearly asserted which provides a motivation to modify Fedder, Kandybowski, Feldman or Korsunsky to satisfy the features of claim 32. For at least this reason, the rejection should be withdrawn. Applicants request that the Examiner reconsider and withdraw the rejection.

(b) Fused to the “Contact”

Swamy and Lin fail to disclose or to suggest this feature. Swamy discloses solder balls (212) attached to pads (210) on the bottom of the connector (200). Lin discloses a semiconductor die (12) with solder bumps (16) secured to bonding pads (14). No motivation has been established to utilize these references in securing a solder mass to a contact of an electrical connector as described in the claim. For at least this reason, the rejection based upon these references should be withdrawn. Applicants request that the Examiner reconsider and withdraw the rejection.

(c) “Fused” to the Contact “Prior to” the Connector Mounting to the PCB

Romine, Seidler and Teka fail to disclose or to suggest this feature. As provided in column 3, lines 19 and 20 of Romine, the solder pellets (52) are preferably “stuck in and on the cavity 50 with a suitable adhesive.” When mounting the connector to the PCB,

"the header 30 and board 22 can be placed in an assembly oven, and the temperature within the oven raised sufficiently to melt the reflux solder pellets 52." Seidler discloses a solder mass (26) placed between tabs (18) on the contact (10). The solder mass is subsequently heated to secure the connector to a PCB. Likewise, Teka, appears to disclose an electronic component with a lead having a shaped piece of solder placed thereon. No motivation has been established to utilize these references in fusing a solder mass to the contact before the connector mounts to the circuit substrate. For at least this reason, the rejection based upon these references should be withdrawn.

Applicants request that the Examiner reconsider and withdraw the rejection.

C. Rejection of Claims 1-41 over Romine in view of Fedder, Feldman, Noshcese, Seidler, Electronics, Teka, Lin and Swamy

The Office action rejected claims 1-41 as being unpatentable over Romine in view of Fedder, Feldman, Noshcese, Seidler, Electronics, Teka, Lin and Swamy. For the various reasons enumerated below, the rejection should be withdrawn.

1. Claims 1, 2 and 4-17

Claim 1 recites, *inter alia*, that the signal contacts have a mating portion with "an elongated cross-section" arranged transversely between the elongated cross-sections of the ground or power contacts such that one end "is located adjacent" one of the ground or power contacts, and the other end "is located adjacent" another of the ground or power contacts.

As seen in Figure 8 of Romine, the contacts have a square cross-section. No motivation has been established to modify Romine to the arrangement described in the claim.

In fact, none of the cited references can provide such a motivation. Specifically, none of the cited references disclose the specific arrangement described in the claim. As previously discussed, neither Fedder nor Feldman disclose or suggest the I-beam geometry provided in the claim. Applicants request that the Examiner reconsider and withdraw the rejection.

In addition to the above discussion regarding independent claim 1, Applicants assert that dependent claim 13 itself defines an invention that is patentable over the cited references. Claim 13 recites, *inter alia*, “recesses” in which the mounting portions of the contacts reside. None of the cited references disclose or suggest such an arrangement. Applicants request that the Examiner reconsider and withdraw the rejection of claim 13.

2. Claims 18-31

Independent claim 18 recites, *inter alia*, an electrical connector with contacts that have solder masses “fused” thereto “before said connector mounts to the circuit substrate.”

As seen in Figure 5, Romine describes an electrical connector (20) with solder pellets (52) secured to pins (32) with adhesive. No motivation has been established to modify Romine as described in the claim. In fact, none of the cited references provide such a motivation. Applicant requests that the Examiner reconsider and withdraw the rejection.

In addition to the above discussion of independent claim 18, Applicants assert that dependent claims 22-25 themselves define inventions that are patentable over the cited references. Claim 22 recites, *inter alia*, that the housing has “recesses” in which the

mounting portions of the contacts reside. None of the cited reference disclose or suggest such an arrangement. Applicants request that the Examiner reconsider and withdraw the rejection of claims 22-25.

3. Claims 32-41

Likewise, independent claim 32 recites an electrical connector with a solder mass “fused” to the tail portion of the contact “prior to” the electrical connector securing to the substrate so that the solder mass is located “further” from the housing than the contact.

Again, Figure 5 of Romine shows an electrical connector (20) with solder pellets (52) secured to pins (32) with adhesive. No motivation has been established to modify Romine as described in the claim. In fact, none of the cited references provide such a motivation. Applicant requests that the Examiner reconsider and withdraw the rejection.

D. Rejection of Claims 18-31 over Noschese in view of Fedder, Lin, Feldman and Swamy

The Office action rejected claims 18-31 as being unpatentable over Noschese in view of Fedder, Lin, Feldman and Swamy. For the various reasons enumerated below, the rejection should be withdrawn.

1. Claims 1, 2 and 4-17

Claim 1 recites, *inter alia*, that the signal contacts have a mating portion with “an elongated cross-section” arranged transversely between the elongated cross-sections of the ground or power contacts such that one end “is located adjacent” one of the ground or power contacts, and the other end “is located adjacent” another of the ground or power contacts.

As seen in Figures 1 and 12 of Noschese, the contacts have either a round or a square cross-section. No motivation has been established to modify Noschese to the arrangement described in the claim.

In fact, none of the cited references can provide such a motivation. Specifically, none of the cited references disclose the specific arrangement described in the claim. As previously discussed, neither Fedder nor Feldman disclose or suggest the I-beam geometry provided in the claim. Applicants request that the Examiner reconsider and withdraw the rejection.

In addition to the above discussion regarding independent claim 1, Applicants assert that dependent claim 13 itself defines an invention that is patentable over the cited references. Claim 13 recites, *inter alia*, “recesses” in which the mounting portions of the contacts reside. None of the cited references disclose or suggest such an arrangement. Applicants request that the Examiner reconsider and withdraw the rejection of claim 13.

2. Claims 18-31

Independent claim 18 recites, *inter alia*, an electrical connector with contacts that “remain[] a distance away from the circuit substrate.”

As seen in Figures 3 and 11, Noschese describes electrical connectors (20,76) with either through hole-mounted contacts (26) or surface-mounted contacts (84) that directly engage the PCB. No motivation has been established to modify Noschese as described in the claim. In fact, none of the cited references provide such a motivation. Applicant requests that the Examiner reconsider and withdraw the rejection.

In addition to the above discussion of independent claim 18, Applicants assert that dependent claims 22-25 themselves define inventions that are patentable over the cited references. Claim 22 recites, *inter alia*, that the housing has “recesses” in which the mounting portions of the contacts reside. None of the cited reference disclose or suggest such an arrangement. Applicants request that the Examiner reconsider and withdraw the rejection of claims 22-25.

3. Claims 32-41

Independent claim 32 recites, *inter alia*, that the solder mass is fused to a location of the contact so that “at least a portion of said solder mass is located further from said housing than said contact.”

In both embodiments of Noschese (Figures 2 and 10), the contacts extend further from the housings than the solder mass. No motivation has been established to modify Noschese as described in the claim. In fact, none of the cited references provide such a motivation. Applicant requests that the Examiner reconsider and withdraw the rejection.

E. Other Considerations

When determining obviousness, the Examiner must also consider factors that evidence non-obviousness. One such factor is when an applicant proceeds contrary to accepted wisdom. M.P.E.P. § 2146.

The present invention is the first “typical” electrical connector to utilize ball grid array (BGA) technology. By “typical,” the undersigned refers to an electrical connector which includes a housing and contacts mounted in the housing.

The Examiner has cited several references¹ which disclose the use of BGA technology on electronic components. However, several significant differences exist between the use of BGA technology on electronic components and on electrical connectors. Applicants assert that these differences help establish the non-obviousness of the present invention.

One major difference between electronic components and electrical connectors is the types of materials used. Electronic components are generally made from materials, such as ceramics, that are generally unaffected by the reflow process that secures the solder balls to the leads. Electrical connectors, especially ones made from plastic, have a greater sensitivity to the temperatures encountered during the reflow process.

Another major difference between electronic components and electronic connectors is the type of use each device encounters. Once secured to the PCB, electrical connectors must engage a mating component, often through multiple mating/unmating cycles. Electronic components, typically, do not encounter such cycling. This cycling may transmit forces to the solder joint between the contact and the PCB. These forces may affect the solder joint of the electrical connector differently than the solder joint of the electronic component, which does not encounter such cycling. For at least these reasons, Applicants have established the non-obviousness of the present invention.

The Examiner has also cited several references² which disclose mere “typical” connectors, stating that it would have been obvious to apply BGA technology to these connectors. Applicants assert that such a conversion goes against conventional wisdom.

¹ Lin, Teka and Electronics.

First, due to the mating/unmating cycles of electrical connectors, Applicants believe that conventional wisdom urges the interaction of at least a portion of the connector structure with the PCB. For instance, Feldman, Fedder and Korsunsky all describe connectors with contacts extending into through-holes in the PCB. Romine discloses a portion of the connector housing extending into the PCB. Also, in the one entirely surface mounted connector embodiment of Kandybowski (see Figure 3), the connector housing receives an edge of the card and the contacts directly engage the PCB. For at least this reason, Applicants assert that mounting a "typical" connector to a PCB using only BGA technology appears contrary to conventional wisdom.

Second, the "typical" connectors cited by the Examiner only encounter, at most, a single reflow operation. The connector of Fedder, which discloses all through-hole tails, does not appear to encounter any reflow operation. As is customary with through-hole tails, the undersigned assumes that a wave soldering operation secures the contacts of the Fedder connector to the PCB. Feldman, Kandybowski and Romine appear to encounter only one reflow operation.

One problem encountered during a reflow operation is the wicking of the solder mass along the contact and away from the solder joint. Importantly, the connector of the present invention undergoes two reflow operations. One reflow operation occurs when the solder masses are initially secured to the contact. The second reflow operation occurs when the connector is mounted to the PCB. Clearly, exposing a connector to an additional reflow operation proceeds contrary to accepted wisdom. Thus, Applicants have again established the non-obviousness of the present invention.

² Fedder, Feldman, Kandybowski, Korsunsky and Romine.

Finally, the Examiner has cited a reference³ describing an atypical connector. Swamy describes a connector housing (202) with insulative pegs (204) extending from one side. The pegs have conductive strips (206) "brazed" thereon⁴. Plated through holes or vias 208 extend through the housing to connect the conductive strips with conductive pads (210) plated on the opposite side of the housing. The pads receive solder balls (212). The Swamy device is atypical since it resembles a PCB more than a connector. As is known, a PCB can have solder pads and plated through-holes/vias. Without mounting the solder masses to a contact, the Swamy device does not present the potential for the solder wicking problem described above. Therefore, Applicants assert that the Swamy reference provides no motivation to apply BGA technology to a "typical" connector. Thus, Applicant has established the non-obviousness of the present invention. Applicant requests that the Examiner reconsider and withdraw the rejection.

III. Newly Added Claims

Applicants added new claims 42-45. Claims 42-45 define inventions that are patentable over the cited references. Applicants did not introduce new matter to the original disclosure. Support for the newly added claims appears, for example, Figures 25, 29 and 33.

IV. Conclusion

In light of the foregoing, Applicants submit that the claims are now in condition for allowance. Applicants request that the Examiner reconsider and withdraw the

³ Swamy.

⁴ The Swamy disclosure is unclear. The term brazing refers to the soldering of two metallic elements. Swamy is unclear since the disclosure describes the brazing of metal to plastic.

rejections. Applicants solicit the allowance of claims 1, 2, 4-20 and 22-45 at an early date.

Applicants authorize the Commissioner to charge the \$72 fee under 37 C.F.R. § 1.16(c) for the presentation of four (4) additional claims, plus any other fees due under 37 C.F.R. §§ 1.16 and 17 during prosecution of the present application, to Deposit Account Number 02-2097.

Respectfully submitted,



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CheraLynn West

12 December 2000
Date of Signature